

# Statistics 133 Final Project:

## Financial Exploration through Statistical Computation

*Extra Credit Presentation*



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Sociology  
2016

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*Technology industries show higher growth and higher beta, and therefore lower PE ratios.*

## Questions We Answered:

1

What is the relationship between beta and the payout percentage?

2

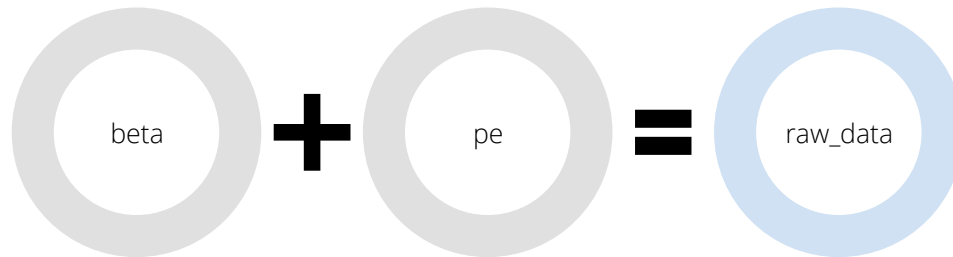
What is the relationship between beta and the expected growth rate?

## Financial Terminology:

- **PE ratio:** market value per share / earnings per share
- **Trailing PE:** derived from previous four quarters
- **Forward PE:** calculated using estimated earnings for the next four quarters
- **Market capitalization:** total dollar value of a company's outstanding shares
- **Unlevered beta:** metric indicating the risk of a company to that of the market

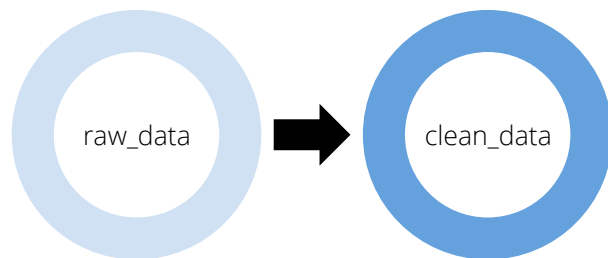
# DATA & PREPROCESSING

## Raw Dataset from NYU Stern School of Business's Data Archives



```
> str(raw_data)
'data.frame': 96 obs. of 15 variables:
 $ Industry          : chr  "Advertising" "Aerospace/Defense" "Air Transport" "Apparel" ...
 $ Number.of.firms   : int   52 93 22 64 22 75 13 676 22 46 ...
 $ Average.Unlevered.Beta : num  0.83 1.06 0.61 0.86 0.59 1.14 0.34 0.37 0.89 0.98 ...
 $ Average.Levered.Beta  : num  1.18 1.16 0.98 0.99 1.09 1.35 0.81 0.53 1.06 1.14 ...
 $ Average.correlation   : chr  "16.05%" "30.81%" "31.63%" "19.57%" ...
 $ Total.Unlevered.Beta  : num  5.15 3.43 1.93 4.39 2.64 4.44 0.79 1.68 4.83 6.16 ...
 $ Total.Levered.Beta    : num  7.36 3.76 3.09 5.07 4.9 5.24 1.88 2.37 5.71 7.18 ...
 $ Current.PE            : num  73 29.8 47.1 27.9 13.6 ...
 $ Trailing.PE           : num  30.4 31.1 28.1 27.8 15.1 ...
 $ Forward.PE            : num  27.5 30.9 14.4 23.9 29.6 ...
 $ Aggregate.Mkt.Cap..Net.Income : num  31.4 19.5 14.7 30.2 10 ...
 $ Aggregate.Mkt.Cap..Trailing.Net.Income : num  22.4 17.8 10.9 24.3 13 ...
 $ Expected.growth...next.5.years : chr  "13.08%" "10.82%" "34.73%" "17.01%" ...
 $ PEG.Ratio             : num  1.71 1.65 0.31 1.43 0.59 1.11 1.69 1.38 1.4 1.89 ...
 $ X                     : logi  NA NA NA NA NA NA ...
```

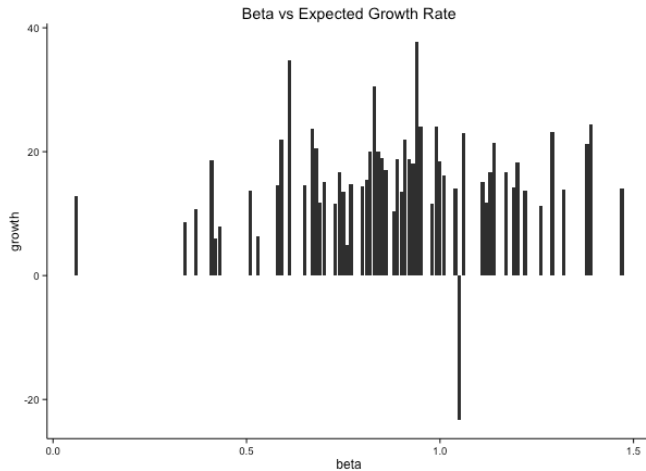
## Preprocessing Raw Data into Clean Data



Steps:

1. Inspect elements within raw\_data
2. Make a copy of raw\_data called "clean\_data"
3. Rename columns
4. Convert character columns to numeric vectors
5. Remove extraneous rows with missing values
6. Inspect clean\_data
7. Write a CSV file of the processed data

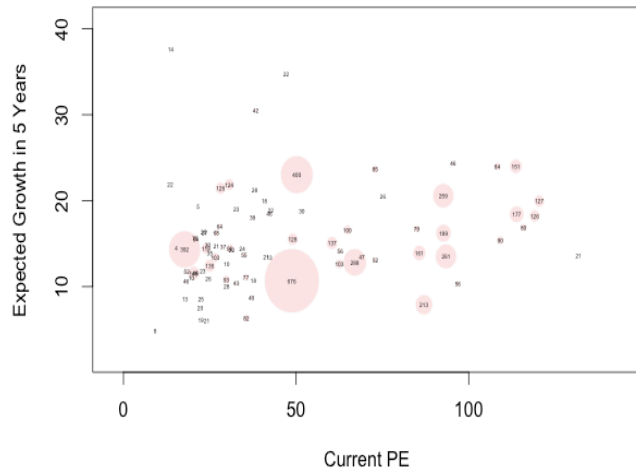
## Histograms



- Used to graphically display the distribution of a variable and its corresponding value to another variable
- Looked at:
  - Current PE, Forward PE, Total Levered Beta, Growth
  - PE Ratio to Average Unlevered Beta
  - Average Unlevered Beta to Expected Growth Rate
  - Current PE to Expected Growth Rate
- We found that industries with high beta are growing industries such as online retail, real estate, and software and those with the lowest beta are stable markets such as finance or trucking

## Bubble Plots and Scatterplots

Current PE Less Than 150 vs Expected Growth in the Next 5 Year



- Used to graphically display the relationship between two variables and add emphasis to a third
- Graphed multiple charts, some of which controlled for outliers
- Looked at:
  - Current PE ratio to Expected Growth in the Next 5 Years, with circles of size corresponding to the size of the specific industry
- We found that most industries had PE ratios that were below 150, but a few had extremely high Current PE, which skewed the data. When accounting for these outliers, we find that most larger industries have PE values between 50 and 100

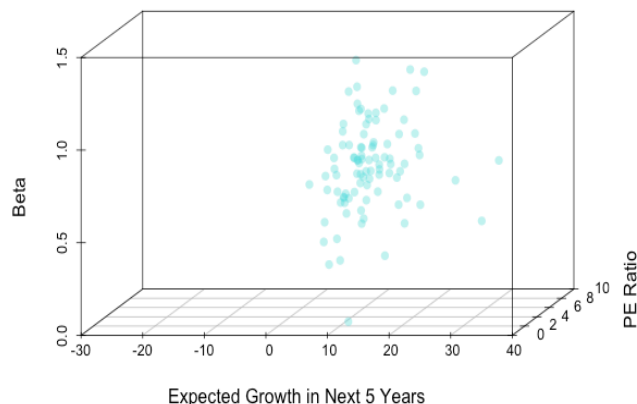
## Linear Regression



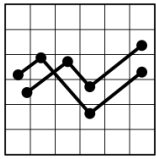
- Used to illustrate the correlation and relationship between variables
- Had multiple scatterplots, some that controlled for outliers or other related variables to maintain accuracy
- Looked at the scatterplots and linear regressions of:
  - Current PE to Expected Growth in the Next 5 Years
  - Expected Growth to Average Unlevered Beta, Current PE, and PEG Ratio
- We found that there was a strong statistical significance of the PEG ratio to growth, as shown in the figure to the right

## 3D Scatterplots

**3D Scatterplot of Expected Growth, PEG Ratio, and Beta**



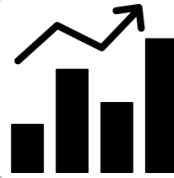
- Used to analyze the relationship between multiple variables
- Examined graph from multiple angles
- Looked at the 3D plot of:
  - Expected Growth in the Next 5 Years, PEG Ratio, and Average Unlevered Beta
  - Expected Growth in the Next 5 Years, Current PE Ratio, and Average Unlevered Beta
- We found that higher beta corresponded with expected growth (as predicted), higher beta was correlated with higher PEG ratio, and that lower expected growth equated with higher PEG ratios



## Beta & Payout Ratio

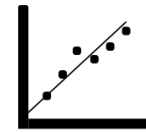
Payout ratio is directly correlated with PE ratio.

Thus, examining the relationship of beta to PE tells us that PE ratio is negatively correlated with beta, and thus payout ratio is negatively correlated with risk.



## Beta & Growth Rate

Higher beta corresponds to a higher growth rate, as expected. Industries with higher beta and risk are those that are growing, such as online retail, real estate, and software, while stable markets have lower beta.



## Tech Industry

Because the technology industry has a high beta, by our analysis of growth rate versus beta, it also has a high growth rate.

Additionally, because beta is negatively correlated with PE ratios, the industry has low PE.



Q&A

# SOURCES

- Front-page picture: <http://qcfinance.in/wp-content/uploads/2013/10/financial-analysis.jpg>
- Financial terminology: <http://www.investopedia.com/>
- Icons: The Noun Project